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CHANGING PATTERNS OF LAND USE IN AUSTRALIA

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THE LAND AND ITS LIMITATIONS

In terms of world agriculture, Australian agriculture is characterised by:

- its heavy dependence upon overseas markets;
- the large scale of activities compared with similar enterprises in other parts of the world
- its heavy and long term concentration on a limited range of products;
- its dependence upon a low rainfall, seasonally dry and periodically droughty environment, and a geologically old land resource with limited fertility and relatively high propensity to degradation;
- the relatively high standard of living of the agricultural community.

The outstanding feature of Australian agriculture is its dependence upon overseas markets. As the Australian community consumes only a small part of the country's total agricultural production, most products must be sold in competition with other major producers, many of whom have large populations to help support their industries. Australian agriculturists must therefore be economically efficient by world standards to compete on world markets.

A large part of the Australian continent is not particularly suited to agricultural production in comparison with the land resources of other major agricultural producers. This is mainly due to the seasonality and limited rainfall of the continent combined with very high rates of potential evaporation, and to prolonged droughts which periodically affect most parts of the Australian continent.

The vast interior of the Australian continent receives little rainfall in either winter or summer (less than 300 mm a year). This, combined with very high potential evaporation (in excess of 3,000 mm a year from a standard pan in which water is available at all times), means that in most years

and in most seasons there is a soil moisture deficit. At best, this part of Australia may be used for extensive livestock grazing. As the northern portion of the continent receives almost all its rainfall (400-1,200 mm) during the hot summer months when evaporation is greatest (2,800-3,200 mm a year pan evaporation), it is less effective for plant growth than in the south of the continent. Generally, there is a severe dry period during the winter, with a consequent need for irrigation for any cropping. The exception is the very high rainfall 'sugar coast' of Queensland which receives more than 1,600 mm of rainfall and has less than 1,600 mm pan evaporation.

The southern portion of the continent receives most of its rainfall (400 -1,200 mm) during the cooler winter months when pan evaporation is usually less than 1,600 mm a year. Consequently there is more soil moisture available for plant growth for a given amount of rainfall than in the north, especially during the wet winter season, when even relatively dry lands may be used to grow cereal crops. The eastern coastal zone receives more rainfall than most other parts of the continent (800 - 1,600 mm a year) and has relatively low pan evaporation (less than 1,600 mm a year). This rainfall occurs during all seasons giving a potential growing season longer than for most other parts of Australia. Because of the rugged terrain and cooler temperatures of the eastern highlands, land use is highly varied, ranging from wilderness to intensive cropping and horticulture.

The Australian climate is also well known for its periods of low rainfall or drought which severely reduce the production of crops and animal forage and expose soils to erosion. Between 1965 and 1980, almost all of southern Australia experienced drought conditions, i.e. received less than the 10 percentile long-term rainfall for between 30 per cent and 40 per cent of all months.

At the commencement of European settlement these broad climatic patterns and limitations were unknown. The range and seasonal variability of the continent's regional climates had to be learnt and appreciated, often by bitter experience. Over the past 150 years, cropping activities were often extended well beyond sensible climatic limits, occasionally causing such hardship and environmental damage that government decrees were enacted to limit the geographical extent of cultivation. In South Australia, for example, Goyder's Line was defined in 1865, while in New South Wales the non-agricultural Western Division was designated in 1901.

Within those lands climatically suitable for agriculture, local areas of steeply sloping lands, or lands with particularly fragile soils impose further restrictions on the pattern of land use. In the past, there was very little appreciation of these limitations of the Australian land resource. Very steeply sloping lands were often cleared for grazing and, worse still, for cultivation which led to widespread and severe erosion in areas such as the Southern Tablelands of New South Wales. In the southern pastoral lands where shrub vegetation, 'saltbush' and 'bluebush' provided forage for sheep and cattle, lack of understanding of annual rates of shrub growth led to gross overstocking which, in conjunction with depredation of huge rabbit populations, precipitated very serious losses of vegetative cover and consequent serious soil erosion. Much of western New South Wales for example, which suffered from these depredations, has never fully recovered and sheep numbers today remain well below those at the turn of the century.

Limitations on land for agriculture may be defined in terms of land capability. Most States are now completing land capability mapping for their agricultural lands, assisting land users to avoid mistakes of the past. But land users are frequently unwilling or unable to change land use practices. Sometimes this is because of difficult economic circumstances; at other times it is because land users have little or no understanding of the long-term consequences of their activities.

Information on the harmful effects of certain land use practices has often been ignored with consequent serious long-term effects. Dry land salinity was observed and explained in terms of extensive clearing of native woodlands in Western Australian wheatlands in the mid-1920s, and Victoria in the early 1960s; rising water tables and salinity led to the abandonment of a number of

early irrigation areas along the Murray River around the turn of the century; and the serious long-term consequences of rising water tables in the Murrumbidgee Irrigation Area have been known since the 1950s.

THE HISTORICAL DEVELOPMENT OF AUSTRALIAN AGRICULTURE

Australian agriculture has passed through the following five broad phases in its continuing evolution since 1788.

1. The earliest phase, from 1788 to around 1820, represents the subsistence period of the early colony.
2. The second phase, from 1820 to 1860, highlights the early export of agricultural commodities.
3. The third phase, from the early 1860s to around the turn of the century, includes the development of the continental pattern of land use.
4. The fourth phase, from 1900 to the 1950s, was a period of adjustment and consolidation.
5. The fifth phase, from the 1950s to the present, has been a period of secondary expansion.

1. 1788-1820

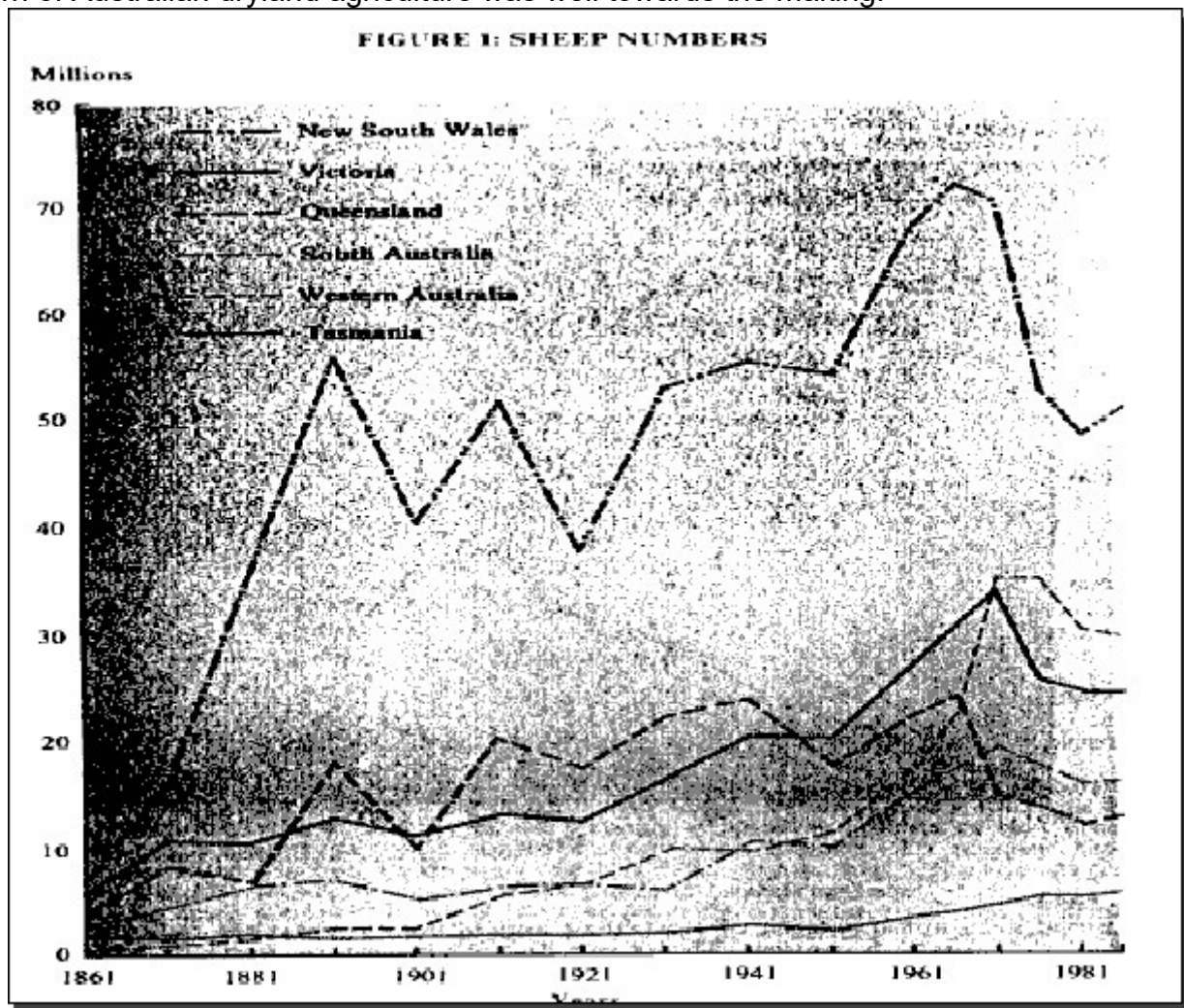
During this period, the colonists of New South Wales and Van Diemen's Land struggled to provide even basic food requirements. They were not always successful in the earlier years and chronic hunger was not uncommon. Lack of agricultural experience, capital equipment of the most rudimentary kinds and of draught animals were complemented by an unknown environment. Towards the end of this period the economic potential of sheep was beginning to be appreciated by Marsden, Macarthur and others, with irregular wool and tallow exports. Exploration, of what proved to be better and far more extensive pastoral lands west of the Dividing Range and the interior of Van Diemen's Land, began in this period. The most important cultivation lands were the Windsor, Parramatta and Liverpool districts near Sydney where wheat and maize were the major crops. Sheep and cattle grazing were concentrated in the Cumberland basin and the south-east of Van Diemen's Land.

2. 1820-1860

This phase was characterised by rapid expansion both of the pastoral industry across Australia and wheat cultivation along the gulf seaboard of South Australia. Elsewhere, grain cultivation stagnated for three reasons: transportation problems were considerable (there were few roads capable of supporting grain laden wagons between the newly settled lands and exporting ports); soils of the older settled areas showed alarming declines in fertility after three to five years of cropping; and wheat varieties particularly suited to the climates of the colonies were not available. However, by the end of this period, draught animals were more plentiful, and manures provided some soil improvement; cultivation and harvesting techniques and machinery suitable for Australian conditions had been developed, for example the wheat stripper; and greater numbers of small farmers or 'dungarees' were turning to wheat cultivation both for export, and throughout the 1850s, to meet an increasing domestic demand.

This period includes three very important changes to the structure of the colonial economies: the cessation of convict transportation; the development of free settler colonies with varying policies for land pricing; and the start of the gold rushes which brought both population and economic wealth to Victoria and New South Wales and later to other colonies. Each had profound effects on Australian colonial agriculture, varying from labour shortages and rapid regional increases in

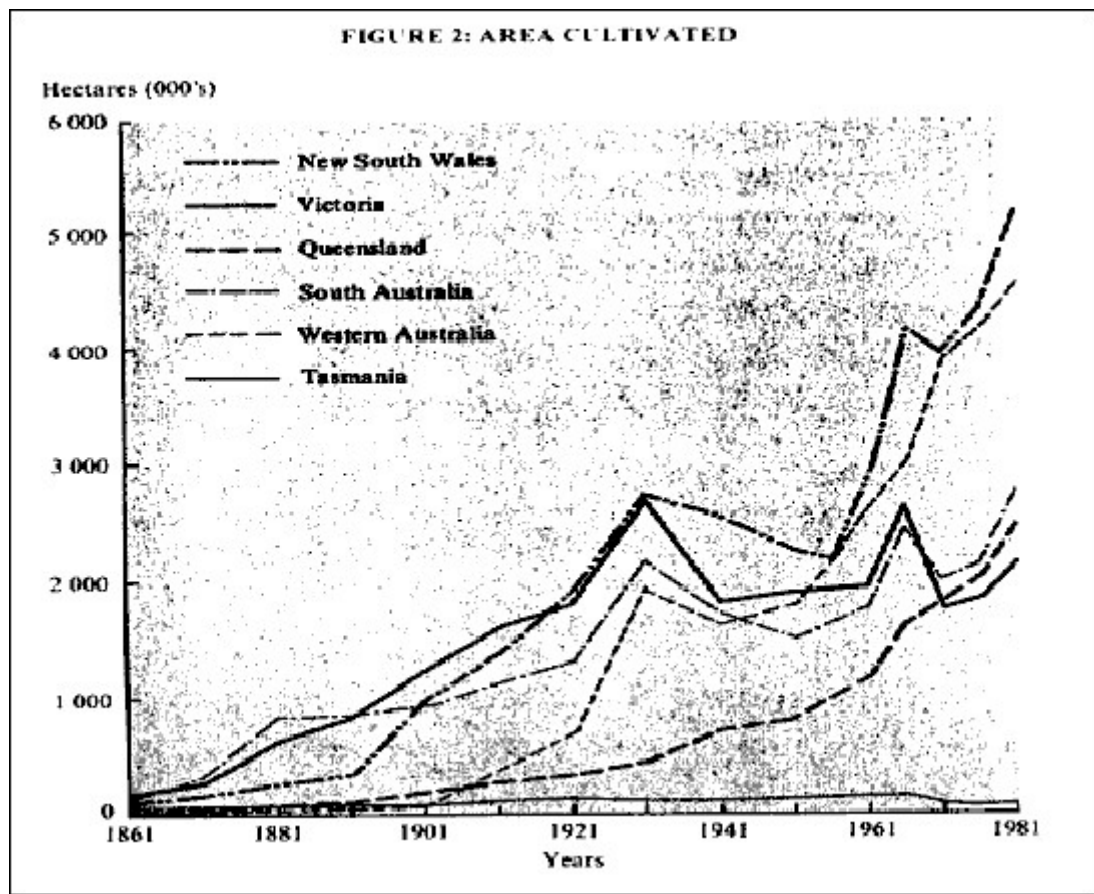
demand for foodstuffs, to long-term land marketing arrangements. By the end of 1860, the combined colonies possessed some 20 million sheep and 4 million cattle, and had almost half a million hectares under cultivation, half of which was wheat. At the end of this period, the broad pattern of Australian dryland agriculture was well towards the making.



3. 1860-1900

From the early 1860s to around the turn of the century the broad pattern of Australian land use was firmly established through the closer settlement Acts such as the Robertson Acts of New South Wales. In this period, a suitable land and water transportation system, was developed for the movement of agricultural products from source of production to the European and especially British markets. Australia became an important exporter of a wide range of agricultural products: wool, wheat, mutton, beef, fruit, sugar and dairy products.

Cattle numbers for the continent doubled in this period with increases of between nine and ten-fold in Queensland and Western Australia. Sheep numbers increased three and a half times for all the colonies with a nine-fold increase in Western Australia and a six-fold increase in New South Wales (see Figure 1). The area cultivated increased around seven and a half-fold for all colonies between 1860 and 1900 with notable increases of over nine-fold in New South Wales and Queensland and over eight-fold in Victoria and Western Australia (see Figure 2). With the exceptions of Queensland and Tasmania, wheat sowings were responsible for most of the increases in cultivated area. In this period, New South Wales and Victoria increased their areas sown to wheat twelve-fold and South Australia and Western Australia, six-fold.



4. 1900-1950

The broad geographic pattern of Australian agriculture did not alter radically during the first half of the twentieth century. The severe drought in eastern Australia which began in the last years of the nineteenth century continued into the new and, combined with the rabbit plague, wreaked havoc on the agricultural economies of the eastern States. There were also notable regional droughts in the 1930s and 1940s and these, with the Great Depression and World War II, had severe impacts on the regional structure of agriculture, although not its geographical pattern. In particular, the economic depression and the droughts of the 1930s reduced many land holders to penury.

During the period 1900 to 1950, there were general agricultural adjustments in regions of harsher physical environments and livestock densities were permanently reduced throughout much of semi-arid Australia. At the same time there was a retreat from the drier margins of agricultural lands. But in all, this was a period of consolidation, based on the reconciliation of a relatively stable technology with a now reasonably well known environment. The two World Wars brought both benefits and problems. They reduced the supply of labour and capital for agriculture but increased the demand for its products. At the end of World War II there were large quantities of American ex-army equipment available which radically altered the level of mechanisation on Australian farms.

Despite setbacks from droughts, wars and economic depressions, national livestock numbers increased notably from 1900 to 1950, although not nearly as rapidly as in the previous period. Australian cattle numbers increased by 69% and sheep numbers by 60%. Only in the Northern Territory were these increases of the magnitude experienced elsewhere in Australia during the previous 40 years. Similarly, the area of cropland (predominantly sown to wheat) slightly more than doubled in this period.

In a 'dry' continent such as Australia, irrigation is often thought of as a major benefit and in this period State governments strongly supported the development of irrigation schemes. Towns such as Mildura and Griffith were established to service the needs of irrigation farmers and to process their products. By the end of this period the total of actual and planned irrigated land of all types comprised almost 3% of all Australia's crop and pasture lands.

5. 1950-PRESENT

This phase of Australian agriculture has involved some remarkable changes in world markets for agricultural products. These changes have precipitated major shifts in the structure and organisation of the agricultural economy. There have been considerable benefits from scientific research into problems of cropping and farm animal husbandry in this period. In particular, the introduction of myxomatosis devastated the immense Australian rabbit population and paved the way for significant increases in livestock numbers. The post-war economic boom and rural to urban migration facilitated widespread mechanisation, which in turn opened up large tracts of hitherto grazing lands in northern New South Wales, central eastern Queensland and southern Western Australia for cereal cultivation. War-time marketing restrictions on agricultural products led to more stable systems for their marketing. Road trucking for livestock helped reduce the impact of local and regional drought. In addition, there has been an expansion of irrigation areas especially for the cultivation of cotton and rice; introduction of a range of new crops such as oil seeds, and improved varieties to suit varying regional conditions; and a general intensification of land use throughout the higher rainfall areas of the southern and eastern portions of the continent.

There have been challenges also to 'traditional' agriculture as the rightful user of all possible lands, and to the right of the agriculturist to ignore long-term ramifications of land use on the land resource. Conservation has become an important influence, both in the sense of improved management of the agricultural land resource to provide long-term sustainable yields, and in the sense of excluding agriculture from areas set aside for the preservation of native species. Urban development has also claimed notable areas of agricultural land along the margins of Australia's major cities for 'extensive' suburban or 'acreage' development and for recreation.

At the same time there have been considerable external pressures on Australian agriculture. Its traditional major market disappeared with Great Britain's entry into the European Economic Community which, because of the strongly supportive policies of that organisation, has now become a competitor with some of Australia's exports. To counter these losses Australian agriculture has had to turn to the U.S.S.R., Japan, and China to dispose of its products, and has had to adjust to meet their particular requirements.

This has also been a period in which the longer term degradation of the Australian land resource has been irrefutable as the results of long-term overstocking and poor cultivation techniques have been scientifically documented and publicly debated. The dryland salinity problem of Western Australian wheatlands and the rapidly increasing water tables of Murray-Murrumbidgee irrigation areas are two such major issues confronting not only the agricultural community but the Australian community at large.

During the 1970s and 1980s Australian agriculture has been in a state of continuous flux with agriculturists experimenting with new techniques and crops; varying the emphasis of their enterprises and gradually increasing the scale of their enterprises to spread the costs of specialised and expensive capital items such as auto-headers and four-wheel drive tractors.

The traditional indicators of Australian agricultural growth, numbers of cattle and sheep and areas of all crops and wheat, remain significant, despite the wide range of changes in the industry. In general over this period, sheep gave way to cattle with a peak in sheep numbers in

1970 and a huge increase in cattle numbers by 1976. Between 1950 and 1980 there was only a 16% increase in national sheep numbers compared to a 79% increase in cattle numbers.

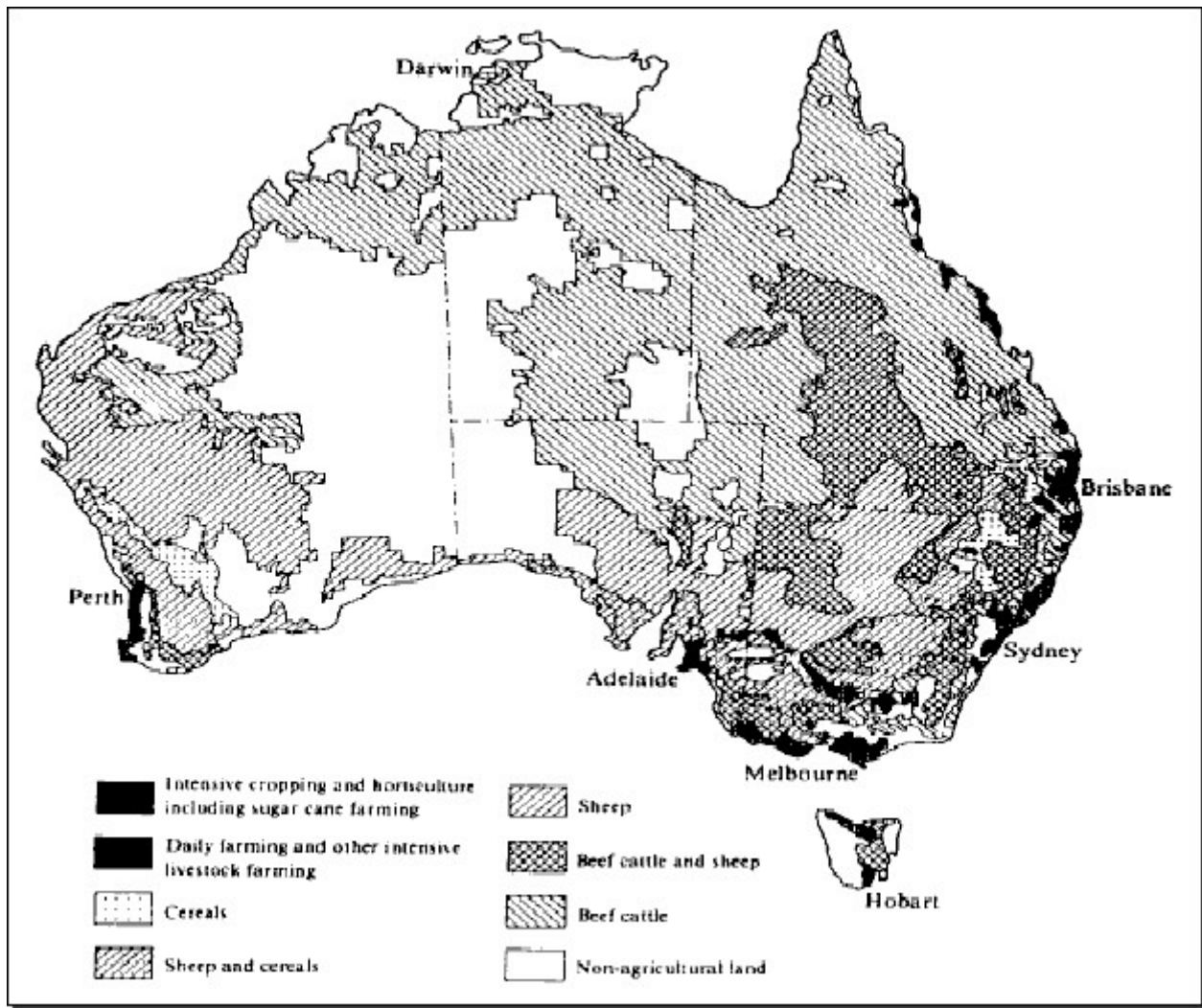
In the same period, the areas sown to all crops and to wheat have grown steadily but consistently with only a 114% increase in cropland and a 125% increase in area sown to wheat. This suggests that with the present world market situation for agricultural products there may be little further increase in arable farming. While on the one hand farmers prefer to move between cropping and livestock as markets change, on the other they are often forced by economic circumstances to cultivate as much area as possible to cover the cost of their expensive cultivation and harvesting equipment. This has occurred to such an extent that many farmers in traditional wool-wheat mixed farming areas no longer follow rotations and have become wheat mono-cultivators. Wheat mono-cultivation, which requires much more precise management to maintain soil fertility and control diseases and weeds, places additional stresses on the Australian land resource, on farm management, and on land administration.

AGRICULTURAL LAND USE IN THE 1980s

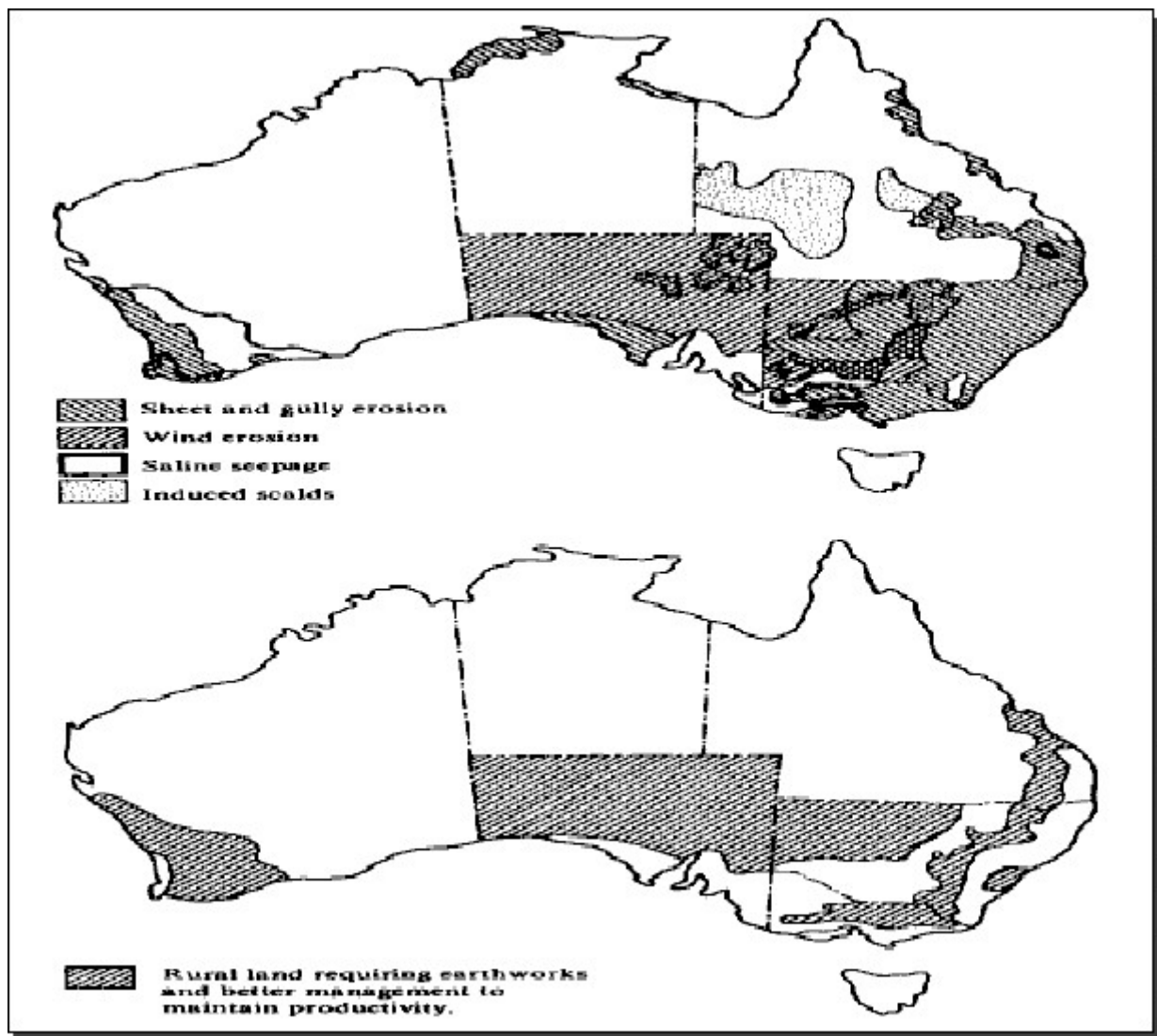
In 1984-85 there were some 488 million hectares in agricultural enterprises in Australia. Only 4% of this area was cropped and 6% was under sown pastures and grasses. The remaining 90% remained under modified or unmodified native vegetation. The total area of agricultural land has remained approximately the same over the past decade. Two States, Western Australia and New South Wales, account for approximately 60% of Australia's cropped land but improved pastures are somewhat more evenly distributed amongst the States with New South Wales, Victoria and Western Australia accounting for 67% of the continent's total.

The area of individual establishments varies considerably according to types of activity. Vegetable growing farms or market gardens in Victoria and Tasmania vary from tens to hundreds of hectares, while cattle stations in the Northern Territory are commonly several hundred thousand hectares in extent. However, the mean size of agricultural establishments for each State is generally indicative of productivity of the land resource. The mean area of agricultural establishments for Australia for 1984-85 was 2,800 hectares, varying from 310 and 390 for Victorian and Tasmanian farms respectively, to 1,200 for New South Wales, 3,150 for South Australian, 4,600 for Queensland and 6,750 for Western Australian farms, with the cattle stations of the Northern Territory averaging an enormous 274,000 hectares.

The types and proportions of types of farming establishments also vary considerably from State to State. In 1984-85 Australia had approximately 173,100 agricultural establishments. In all States and the Northern Territory, livestock grazing dominates farming activities. Cereals cultivation and mixed cereals cultivation with sheep or beef cattle involves approximately 20-55% of all farms except in the Northern Territory. Most types of farming are widely spread among States (see Figure 3), and conversely most States have a wide range of farm types, with a few exceptions: sugar cane farms are almost exclusively in Queensland (91%) as are peanut farms (99%); tobacco farms are mostly in Queensland (59%) and Victoria (36%) and cotton farms in Queensland (45%) and New South Wales (55%). Agricultural establishments in the Northern Territory are almost exclusively beef cattle stations. Diversity of farm type by State, combined with a degree of flexibility in livestock and cropping components in southern Australia have proved advantageous in periods when one or two agricultural products receive low prices, but offer little advantage during periods of generally depressed agricultural markets.



The largest areas of irrigation occur in New South Wales and Victoria which include 41% and 34% of the continent's irrigated lands respectively. In New South Wales almost 60% of these irrigated areas are in State irrigation schemes (56% of irrigated area) and the emphasis has been on high value field and cereal crops such as cotton and rice. In Victoria, where there is also a heavy dependence on State irrigation schemes, emphasis has been on intensive livestock grazing (dairying and fat lambs) and horticulture (dried vine fruits). Queensland which has some 16% of the nation's irrigated lands depends heavily on underground water supplies and only 25% of the irrigated land receives its water from State irrigation schemes. Many of Australia's irrigation areas face serious problems of rising water tables because of the soils on which they were developed and water management techniques employed.



AUSTRALIAN AGRICULTURE IN THE COMING DECADE

It seems likely that Australian agriculture will face a very competitive future with comparatively lower world prices for cereals and meats than have been experienced over the past two decades or so. It is doubtful whether this will markedly alter the structure of the industry or its geography, however it may accelerate trends towards larger and more economically efficient farming enterprises.

Perhaps the most worrying for the longer-term is the degradation of the land resource base of Australian agriculture. It is widely accepted that many of Australia's most productive agricultural lands are at risk to water erosion, wind erosion and salinity. Figure 4, adapted from a national survey of land degradation in the mid-1970s, indicates generally where these problems occur. Other forms of degradation also occur over much of our best agricultural lands but are more readily treated. For example, soil acidity in heavily fertilised grazing lands can be rehabilitated by applications of lime; and areas of soil structural damage caused by continuous use of heavy equipment may be restored by conservation farming techniques.

Australian agriculture will undoubtedly continue to face competition from other forms of land use for resources; plantation forestry is currently replacing marginal agriculture in the higher wetter lands of south-eastern Australia; the requirement for land and water as recreation resources will also expand, and the competition for water resources from urban development will continue to increase. On the more positive side, the agricultural community including farmers, politicians,

State government advisers and administrators, and agricultural land and water resources scientists are now well aware of these problems and are constantly seeking ways to assist Australian agriculture evolve to face the world market situation and to ameliorate the effects of resources constraints.

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